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during at least one stage of predetermined heat cycle, providing a gas to selectively control the temperature of at least one of said localized regions of said semiconductor wafer to minimize temperature deviation of said at least one localized region from said predetermined temperature, said gas being supplied by a gas pipe located above said semiconductor wafer, wherein said gas pipe has a plurality of gas outlets.

REMARKS

Favorable consideration and allowance of the present application is respectfully requested.

Currently, claims 1-2, 4-13, and 42-48 are pending in the present application, including independent claims 1, 46, and 48. Independent claim 1, for instance, is directed to a method of heat treating a semiconductor wafer placed in a thermal processing chamber. While present within the thermal processing chamber, the wafer is subjected to a predetermined heating cycle that can include various heating and/or cooling stages. For example, the predetermined heating cycle includes at least one heating stage in which a plurality of lamps heat the wafer. The method of claim 1 also includes providing a gas to selectively control the temperature of at least one of a plurality of localized regions of the wafer to minimize temperature deviation of the localized region from a predetermined temperature.

Various advantages and benefits are achieved through this method. For instance, the temperature profile of the semiconductor wafer can be maintained at a substantially uniform temperature throughout the entire predetermined heating cycle, which may include ramp-up, steady state, and ramp-down stages. Moreover, by

maintaining the temperature profile of the wafer at substantially uniform temperatures, the resulting method can be used, for example, to effectively anneal a silicon wafer and/or thin films or layers formed thereon, as well as to form ultra-thin coatings and films on the wafer.

In the Office Action, independent claim 1 was rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,926,742 to Thakur et al., in view of U.S. Patent No. 5,846,375 to Gilchrist et al. Thakur et al. is directed to a method in which high intensity heat radiation is used as a means to control and correct warpage and related deformation arising from semiconductor fabrication processes. For example, as shown in Fig. 4, Thakur, et al. describes a rapid thermal processing (RTP) chamber 14 that contains a plurality of lamps 18. However, as correctly noted by the Examiner, Thakur et al. fails to teach selectively controlling the localized temperature of at least one localized region of the semiconductor wafer to minimize temperature deviation of the localized region from a predetermined temperature as required by independent claim 1.

Nonetheless, as indicated above, Gilchrist et al. was combined with Thakur, et al. in an attempt to render obvious the limitations of independent claim 1. Gilchrist et al. is directed to a temperature control system for regulating the temperature of a chuck to which a wafer is mounted during plasma etching. The temperature control system includes a set of conduits arranged about the center of the chuck as a series of concentric radially adjacent loops. Each conduit has its own inlet and outlet for allowing a heating or cooling agent to flow independently through each of the conduits. (Col 2, lines 52-65). For example, referring to Fig. 1 of Gilchrist et al., a reaction chamber 16 is

shown that includes a semiconductor wafer 18 mounted on the upper surface of a bottom electrode 14 that also serves as a mounting chuck. The top electrode 12 and the bottom electrode 14 are situated parallel to and opposite one another in reaction chamber 16. The wafer 18 is cooled during the etching process through a series of conduits 32a-32d that are embedded in the body of the electrode 14 and preferably arranged about its center as a series of concentric radially adjacent loops. (Col 4, lines 18-45).

Applicants respectfully submit, however, that one of ordinary skill in the art would not have found it obvious to combine the above-cited references in the manner suggested in the Office Action. For instance, as noted above, Thakur, et al. describes a RTP system that utilizes lamps for heating. On the other hand, Gilchrist, et al. is directed to a system that utilizes a chuck that contacts the wafer for heating. As noted in the present application, lamps have much higher heating and cooling rates than electrical elements (i.e., chucks). (Appl. pg. 11). Lamps create a rapid isothermal processing system that provide instantaneous energy, typically requiring a very short and well controlled start up period. The flow of energy from lamps can also be abruptly stopped at any time. Based on the vast differences in these types of heating systems, one of ordinary skill in the art simply would not have found it obvious to utilize control techniques associated with a chuck-based system in a RTP system.

Applicants note that despite the contentions set forth in the Office Action, the teachings of the references must be viewed in their entirety, i.e., as a whole, to sustain a *prima facie* case of obviousness under 35 U.S.C. §103(a). In this case, the prior art as a whole does not teach the desirability of combining all of the aspects of the above-

cited references in the manner suggested in the Office Action. For instance, there is simply no suggestion whatsoever to incorporate a cooling system specifically designed for chuck-based heating into a RTP heating method.

With respect to dependent claims 2 and 4-13, Applicants respectfully submit that at least for the reasons indicated above relating to independent claim 1, such claims patentably define over the references cited. However, Applicants also note that the patentability of dependent claims 2 and 4-13 certainly does not hinge on the patentability of independent claim 1. In particular, it is believed that some or all of these claims possess features that are independently patentable, regardless of the patentability of claim 1.

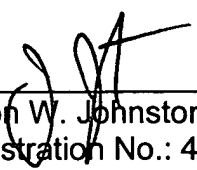
In summary, it is respectfully submitted that the claims are patentably distinct over the prior art of record. Thus, it is submitted that the present application is in complete condition for allowance and favorable action, therefore, is respectfully requested. Examiner Lee is invited and encouraged to telephone the undersigned at her convenience should any issues remain after consideration of the present response.

Please charge any additional fees required by this Amendment to Deposit Account No. 04-1403.



Respectfully submitted,

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